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BASIC PLANNING GUIDE FOR VOCATIONAL AND TECHNICAL EDUCATION FACILITIES.

BY- CHASE, WILLIAM W. AND OTHERS

DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
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THE VOCATIONAL EDUCATION ACT OF 1963 WAS CREATED FOR THE PURPOSE OF IMPROVING EXISTING VOCATIONAL EDUCATION PROGRAMS AND DEVELOPING NEW ONES. ALSO, IT WAS TO ENABLE YOUTHS TO CONTINUE THEIR EDUCATION WHILE PERMITTING PART-TIME EMPLOYMENT. COMMUNITIES DESIRING TO IMPLEMENT SUCH PROGRAMS NEED TO SURVEY THEIR AREA FOR PROGRAM AND BUILDING NEEDS. USE OF QUALIFIED CONSULTANTS SHOULD BE PRECEDED BY CONSIDERATIONS OF QUALIFICATIONS, SELECTION PROCEDURES, AND FUNCTIONS. PLANNING FOR FACILITIES SHOULD REQUIRE CONSIDERATION OF SITE FACTORS AND PROGRAM NEEDS. SPECIFIC DESIGN AND FUNCTION NEEDS ALSO ARE TO BE CONSIDERED. THIS DOCUMENT INCLUDES DEFINITIONS, CHECKLISTS, DIAGRAMS, CHARTS, AND A GLOSSARY OF TERMS. THIS BOOKLET IS AVAILABLE AS CATALOG NUMBER FS 5.280-80040 FOR 20 CENTS FROM THE SUPERINTENDENT OF DOCUMENTS, U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. 20402. (RH)

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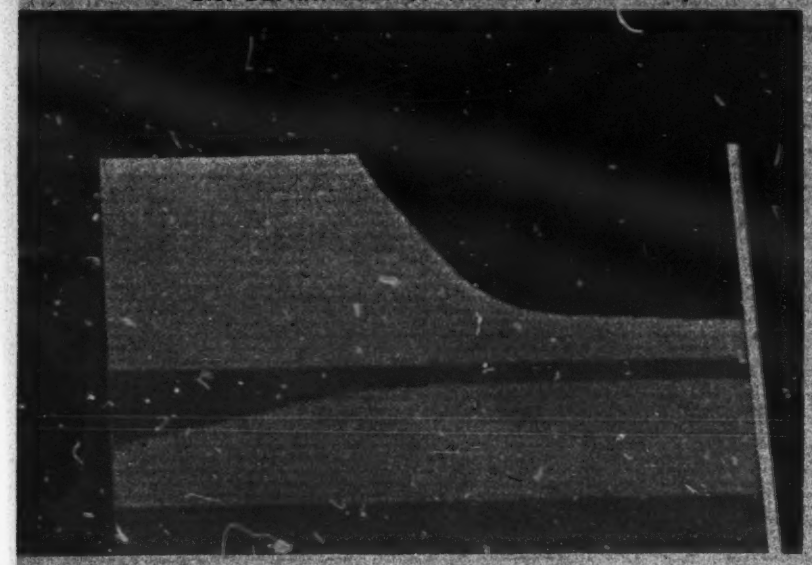

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OE-80040

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BASIC PLANNING GUIDE FOR VOCATIONAL AND TECHNICAL EDUCATION FACILITIES

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FOREWORD

THE VOCATIONAL EDUCATION ACT OF 1963 provides Federal funds for the construction and remodeling of vocational facilities. The Congress, in passing this Act, was well aware of the need for new skills, training, and/or retraining to meet modern demands upon labor and industry and to enhance economic growth and productivity. President Johnson said of the Act, "It will expand educational opportunities at the grade school level, at the college level, and at the vocational school level. This bill . . . is dramatic evidence of our commitment to education as the key to our social and economic and technological and moral progress."

The hope, therefore, of a majority of the American people for the training necessary to earn a livelihood, to be self-supporting, and to contribute to the welfare of this country lies in the quality of the vocational and technical education programs provided for them. The kinds of facilities planned and constructed to accommodate those programs will play an extremely important part in creating the proper environment conducive to the types of education and training needed.

The emphasis which the Congress, through this Act, has placed on vocational education and, particularly, the planning and construction of facilities will, in many instances, involve people who have not yet had this type of experience. To be of assistance to them and as a means of implementing the Vocational Education Act of 1963, this *Guide* outlines major considerations and basic principles in planning facilities for vocational and technical education.

It is intended primarily for State and local directors of vocational education; members of local, area, or regional boards of education legally responsible for schools authorized under this Act; architects; engineers; and others who are specifically involved in planning these facilities.

This *Guide* was prepared cooperatively by the School Housing Section and the Trade and Industrial Education Branch. Special acknowledgment is made to Dr. Edwin L. Rumpf, Assistant Director, Division of Vocational and Technical Education; Dr. Byrl Shoemaker, State Director of Vocational Education, Ohio; George M. Schaffer, Principal, Bucks County Technical School, Fairless Hills, Pa.; and Architects Harry V. Bonner, Jr., William H. Ostermayer, and David J. Pfeiffer for their assistance.

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VIRGINIA

FOREWORD

INTRODUCTION

THE VOCATIONAL EDUCATION ACT OF 1963 AS IT PERTAINS TO VIRGINIA

Purpose

Definition of Terms as Specified in the Act

SURVEY OF AREA NEEDS

The Survey

Questions To Be Answered

Training Areas in Vocational Education

CHECKLIST OF STEPS FOR PLANNING AREA VOCATIONAL FACILITIES

CONSULTANT SERVICES

Educational Consultants

Architects

Services Available in Connection with Selection of Building Site

BASIC CONSIDERATIONS TO BE MADE IN PLANNING AREA VOCATIONAL FACILITIES

The Site

The Building

Space Requirements

Page

EDUCATIONAL SPECIFICATIONS 20
What Are They? 20
What Are Their Values? 20
What Do They Include? 20
Who Develops Them? 21

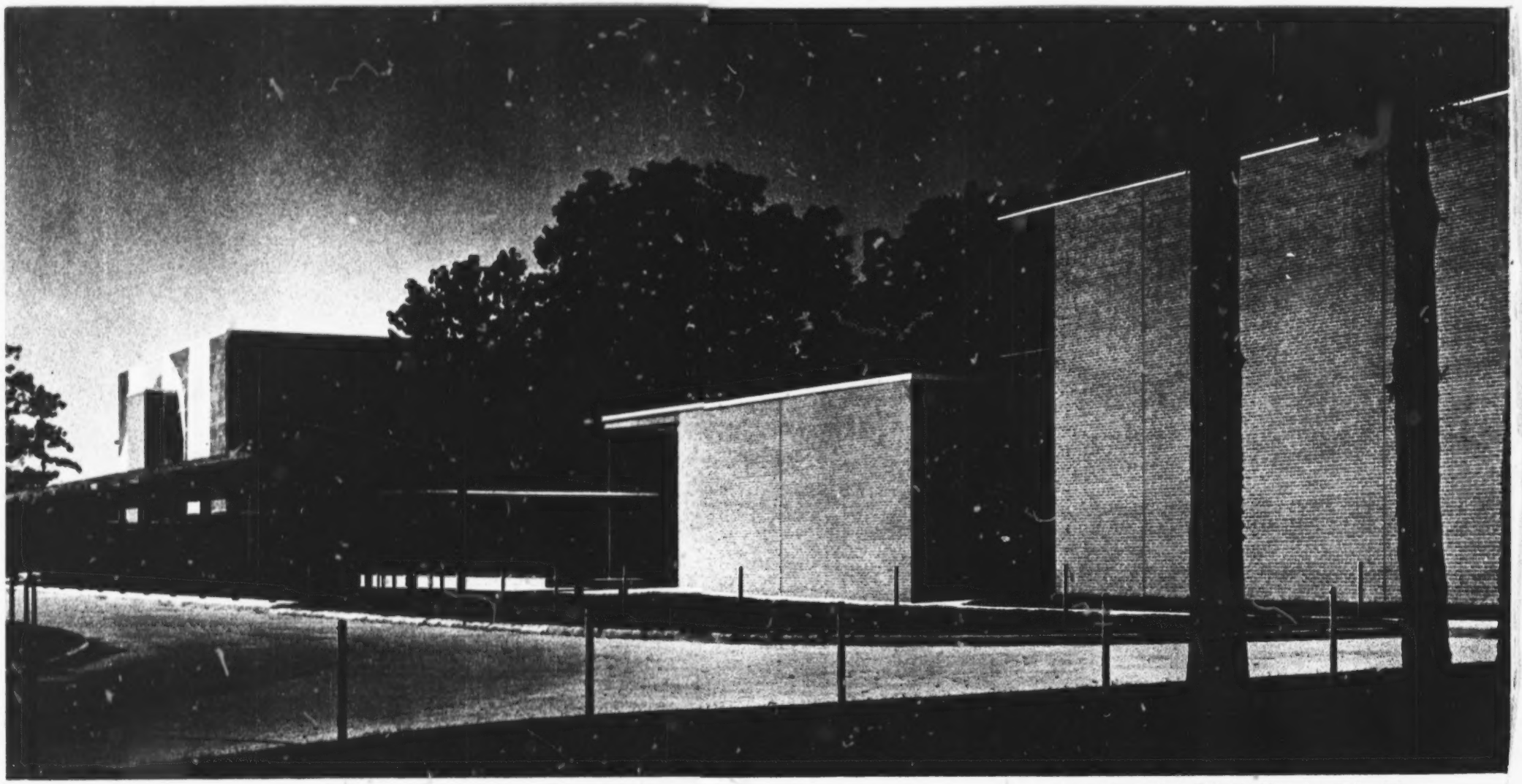
GENERAL PLANNING SUGGESTIONS 22
Program Planning 22
Location of Rooms 22
Shop and Laboratory Planning 23
Safety Precautions and Equipment 24

SCHOOL CONSTRUCTION COSTS AND CAPITAL OUTLAY 25
Units of Measure for Estimating Construction Costs 25
Methods of Determining Areas in School Buildings 25
Variables in Cost Comparisons 25
Cost Estimates of School Construction 26
Proposed Construction Budget Items 26

ECONOMIES IN PLANNING AND CONSTRUCTING VOCATIONAL EDUCATION SCHOOLS 27

GLOSSARY OF FACILITIES PLANNING TERMS 29

BIBLIOGRAPHY 31



This is a comprehensive high school accommodating 1,500 pupils in grades 10–12. The Vocational wings include space for general metals and machine shops, general woodworking shops, drafting, homemaking, craft shops, and fine arts.

Woodlawn High School, Shreveport, Louisiana
Caddo Parish School District

INTRODUCTION

The impact on vocational education programs and building planning and construction will be greatly increased as a result of the passage of the Vocational Education Act of 1963. The Act authorizes the use of funds for the construction of area vocational education school facilities. The Act also states that at least 33⅓ percent of each State's allotment for any fiscal year ending prior to July 1, 1968, and at least 25 percent of each State's allotment for any subsequent fiscal year shall be used for either the construction of area vocational education school facilities or vocational education for persons who have completed or left high school and who are available for full-time study in preparation for entering the labor market, or both. Significantly, these funds will be allocated to the States on a per-capita equalization ratio and are to be matched on a 50-50 basis.

The emphasis upon the area vocational school and the types of programs specified in the Act will necessitate programs of planning quite different from those normally associated with the usual elementary, secondary, or community college units. Further, many people who have had relatively little prior experience in this type of activity will assume responsibility for various aspects of planning those programs and facilities.

The intent of this booklet is, therefore, to acquaint local planners—board members, school administrators, citizen committees, architects, and other interested persons—with the aspects of the Act which pertain to construction of area vocational schools and with basic principles involved in planning such facilities. The material has been obtained from a wide variety of sources and condensed in outline form deliberately to serve as a ready reference, particularly for those individuals or groups who might be involved in the early stages of planning.

The booklet will provide answers or references to such questions as the following:

1. What are the basic implications in the Act for facilities construction? (See page 3.)
2. How does a planning group determine the vocational program and facilities needed in its district or area? (See page 5.)
3. What training areas should be considered or included in a vocational program? (See page 6.)
4. What are the major steps to be followed in planning and constructing an area vocational school? (See page 9.)
5. What kinds of consultant services are available, and where can they be obtained? (See page 10.)
6. What are the qualifications and functions of the architect, and how is he selected? (See page 10.)
7. What factors are involved in site selection and building planning? (See page 14.)
8. What general building design considerations should the board or planning group be aware of? (See page 15.)
9. What kinds of information does the architect need to design a building effectively and efficiently? Who prepares the information? (See page 20.)
10. What are the detailed facilities planning suggestions to be considered? (See page 22.)
11. How are construction costs measured? What variables should be considered in estimating costs? (See page 25.)
12. In preparing a capital outlay budget for construction, what items should be included? (See page 26.)
13. How and in what ways can construction costs be reduced? (See page 27.)
14. Where can additional information about facilities planning be obtained? (See page 31.)

THE VOCATIONAL EDUCATION ACT OF 1963 (P.L. 88-210)

Purpose

The purpose of this Act is to authorize Federal grants to States to:

Improve, maintain, and extend existing programs of vocational education, realistic in the light of anticipated opportunities.

Develop new programs of vocational education.

Provide part-time employment to youths to enable them to continue their vocational education training on a full-time basis.

Provide vocational education for those in high school, and those who have completed or discontinued their formal education and are preparing to enter the labor market but need to upgrade or learn new skills.

Provide programs suited to meet the needs, interests, and abilities of the students to enable them to benefit from such training.

Definition of Terms as Specified in the Act

Vocational education—Vocational or technical training or retraining given in schools or classes under public supervision and control, or under contract with a State board or local educational agency.

Objective of vocational education—To fit individuals for gainful employment as semiskilled or skilled workers or technicians in recognized occupations.

Area vocational school

(a) A specialized high school used exclusively or principally for the provision of vocational education to persons who are available for full-time study in preparation for entering the labor market, or

(b) The department of a high school exclusively or principally used for providing vocational education in no less than five different occupational fields to persons who are available for full-time study in preparation for entering the labor market, or

(c) A technical or vocational school used exclusively or principally for the provision of vocational education to persons who have completed or left high school and who are available for full-time study in preparation for entering the labor market, or

(d) The department or division of a junior college or community college or university which provides vocational education in no less than five different occupational fields, under the supervision of the State board, leading to immediate employment but not leading to a baccalaureate degree, if it is available to all residents of the State or an area of the State designated and approved by the State board, and if, in the case of a school, department, or division described in (c) or (d), it admits as regular students both persons who have completed high school and persons who have left high school.

School facilities—Classrooms and related facilities (including initial equipment) and interest in land on which such facilities are constructed. Such term shall not include any facilities intended primarily for events for which admission is to be charged to the general public.

Construction—Construction of new buildings and expansion, remodeling, and alteration of existing buildings; includes site grading and improvement, and architect fees.

Occupational field—A group of recognized occupations having substantial similarities common to all occupations in the group: for example, similarity in the work performed; similarity in the abilities and knowledge required of the worker for successful job performance; similarity in the tools, machines, instruments and other equipment used; and similarity in the basic materials worked on or with. The term is applied, in the case of Federal participation in the construction of an area vocational school, to determine whether a department of a certain type of high school, or a department or division of a junior college, community college, or university provides "vocational education in no less than five different occupational fields." The purpose is to assure that such schools will have offerings that will afford prospective students of varying interests a reasonably broad choice of the type of occupation for which they are to be trained. Determinations of what is an "occupational field" will be made in the light of this purpose.

SURVEY OF AREA NEEDS

The Survey

To provide and analyze essential information on which to base decisions for the vocational program.

To propose a program to meet these requirements.

To determine the facilities (site, building, furniture, and equipment) needed to accommodate the proposed program.

Questions To Be Answered

What are the business and industrial needs, interests, and potential?

What are the students' needs, interests, and potential?

What are the opportunities for the vocational education program?

Would a residential school be more advantageous than a day school?

What physical facilities are presently available?

Can the present facilities be suitably and efficiently adopted?

How can the program operation and building construction or remodeling be financed?

What businesses and industries are presently in operation?

What are the types of jobs available and the number of employees needed to fill them?

What is the potential for expansion or diversification?

What are the implications for training or retraining?

What are the implications for general education?

What are the immediate and long-range program and facilities needs? How can the planning for both best be coordinated?

What facilities are presently available for teaching vocational-technical education?

What are the student (or employee) interests, aims, and objectives?

What types of programs should be offered?

What are the qualifications of available instructional staff?

How many students are to be accommodated?

What local, State, and Federal funds are available for financing the program?

How is the program to be financed?

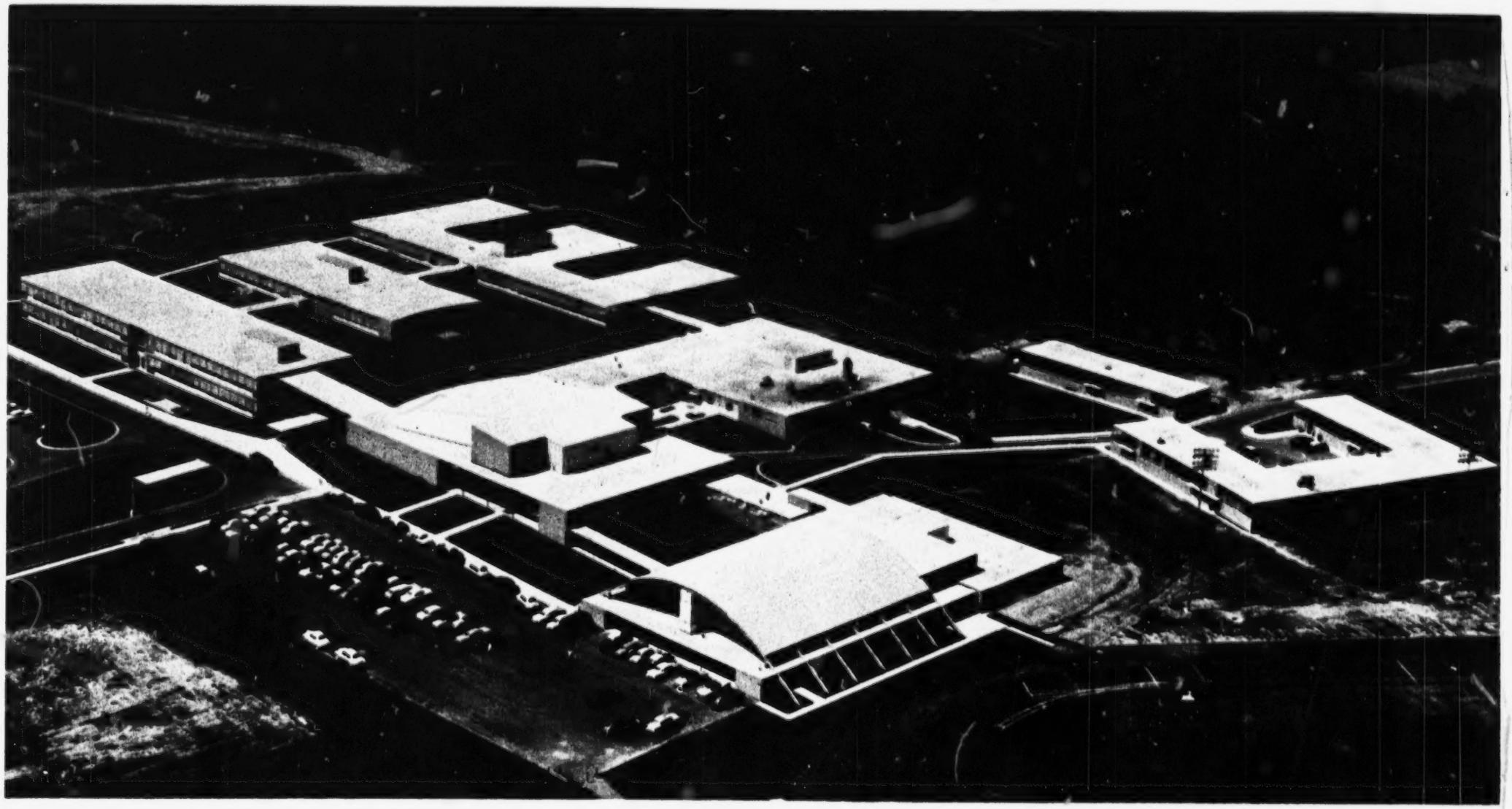
Training Areas in Vocational Education

After surveying area needs, consideration should be given to the following major curriculum areas when planning a vocational facility to insure the development of a well-rounded program:

- Air conditioning and heating
- Agriculture
- Automotive trades
- Aviation
- Building construction
- Chemical trades
- Commercial art
- Cosmetology
- Data processing and programing
- Distributive education
- Drafting
- Electrical trades
- Electronics
- Food service
- Health occupations
- Highway construction
- Home economics
- Mechanical trades
- Office education
- Printing
- Refrigeration
- Watchmaking and instruction

DeKalb Area Vocational-Technical School, DeKalb County, Ga.

The two-story building in the foreground contains the administrative offices and the secretarial science, data processing, clerical, and science programs. The electrical, automotive, and mechanical trades buildings to the rear are designed as independent units, with service drives provided to each. A covered walkway connects all four buildings.



An air view of a campus-type arrangement, parking, and entrances. The Vocational-Technical Center in the upper right can be used as part of the comprehensive high school program.

South Hagerstown High School, Hagerstown, Md.

CHECKLIST OF STEPS FOR PLANNING AREA OR REGIONAL FACILITIES

- ☐ 1. Survey and analyze vocational opportunities, training skills needed, and student interests.
- ☐ 2. Consult with State directors of vocational education and educational plant services.
- ☐ 3. Establish a local educational agency having administrative control and direction of a vocational education program.
- ☐ 4. Submit plans to State agencies in accordance with established rules and regulations.
- ☐ 5. Select an educational consultant, legal counsel, architect, and other professional advisers.
- ☐ 6. Develop educational specifications.
- ☐ 7. Plan a finance program, including capital outlay and current operating expenses.
- ☐ 8. Select and acquire a site.
- ☐ 9. Develop and approve preliminary and final architectural drawings, specifications, and other contract documents.
- ☐10. Plan site development and landscaping.
- ☐11. Prepare specifications on furniture and equipment needs.
- ☐12. Secure construction bids, award contracts, and erect the building in conformance with the official plans.
- ☐13. Purchase and install furniture and equipment.
- ☐14. Accept and occupy the completed building.

CONSULTANT SERVICES

Educational Consultant

Qualifications

Training and administrative experience in education and research, with planning and construction experience. May be a private consultant working independently or with a firm, on a fee basis; or a staff member from a university, a State department of education, or the U.S. Office of Education on a service or reimbursable basis.

Method of selection

By open selection if the consultant is to be paid for his services. By request if consultant service is obtained from a State department of education or the U.S. Office of Education.

Functions

Advise the board of education and the superintendent or director on educational aspects of the building program. Develop educational specifications for approval by the board of education. Interpret educational specifications to the architect, and check architectural plans in terms of the specifications adopted. Conduct the educational survey of the area, advise on the selection of a site, and aid in the selection of furniture and equipment.

Architect

Qualifications

Technical training and certification in the fields of architecture and/or engineering; practical experience; creative ability; business acumen.

Method of selection

Open selection—based on general qualifications.

Competitive design—based on presentation of the best solution in a design competition.

(A standard form of questionnaire for the selection of architects, devised and approved by the National Council of Schoolhouse Construction and by the American Institute of Architects, is included on the following pages.)

THE AMERICAN INSTITUTE OF ARCHITECTS

AIA DOCUMENT B431
SEPT. 1963 ED.

AIA DOC. B431 SEPT. 1963 ED.

STANDARD FORM OF QUESTIONNAIRE FOR THE SELECTION OF ARCHITECTS FOR SCHOOL BUILDING PROJECTS

TEXT JOINTLY OWNED BY NATIONAL COUNCIL ON SCHOOLHOUSE CONSTRUCTION AND THE AMERICAN INSTITUTE OF ARCHITECTS. THIS FORM MAY BE DUPLICATED PROVIDED IT IS REPRODUCED VERBATIM AND ADVANCE PERMISSION IS GRANTED BY BOTH OWNERS

DATE:

ARCHITECT:

PROJECT NAME:

A INFORMATION BY THE SCHOOL SYSTEM TO THE ARCHITECT:

1 Name of school system:

2 Name of superintendent or other person to whom questionnaire should be returned:

3 Size of system (pupil enrollment):

4 General description of proposed projects:

5 Approximate timetable for planning and construction period:

B ARCHITECT'S QUESTIONNAIRE:

1 Name:

2 Business address:

3 Telephone number:

4 Type of organization (check one):

- ☐ Individual
- ☐ Partnership
- ☐ Corporation

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1735 New York Ave NW., Washington, D. C.

5 Names of principals, professional history, professional affiliation, key personnel, staff organization; (attach information if you prefer):

6 Attach list of completed buildings your firm has designed during recent years. If you have recently established your own practice, indicate prior responsible affiliation with other projects, underline those which you feel are examples of your work appropriate to our problem and which you would like to have visited. Include cost of building, type of building, location and dates of construction.

7 Give names of persons to whom the board of education may write. These persons should have knowledge of your firm and your work:

8 Attach any other material which might help the board of education in giving you proper consideration. In questions 7 and 8, the board is interested in finding out about your:

- integrity
- thoroughness
- creativeness
- adequacy of supervision
- business procedures and record keeping on the project
- financial responsibility

9 If you are called in for an interview, you will be asked to furnish information indicating:

that your organization is adequate to do the project

- that previous commitments will not prevent expeditious planning of this project
- that you are willing to devote time to carry out cooperative educational planning with designated school staff members or committees
- completeness of contract documents (drawings and specifications)

Functions

Review educational program requirements.

Advise on site selection.

Prepare preliminary drawings of buildings and site plans.

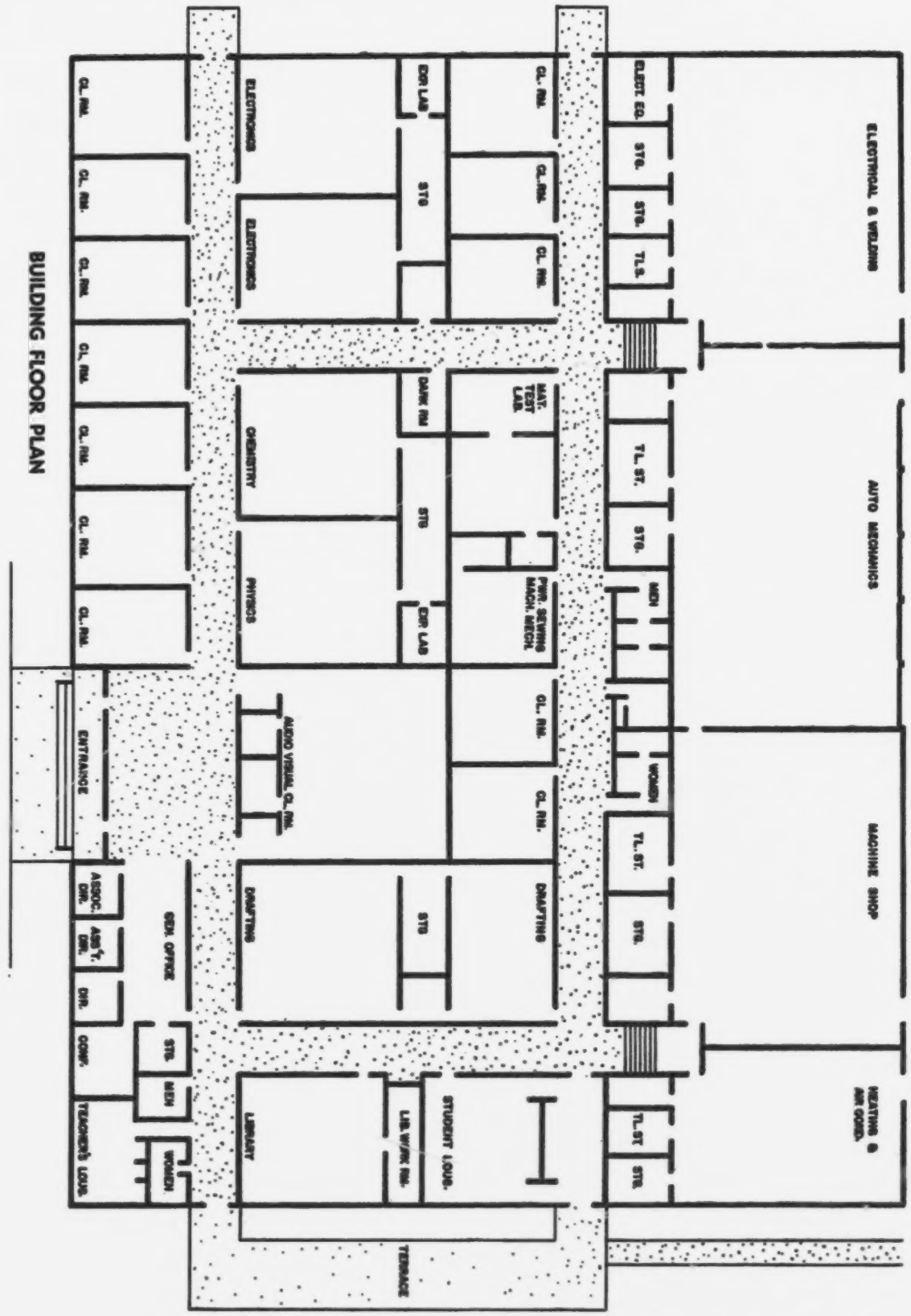
Provide competent estimates of construction cost.

Select structural methods and materials.

Prepare working drawings and specifications—the contract documents.

Prepare bid forms and advertisements, secure and tabulate bids, and recommend contractors.

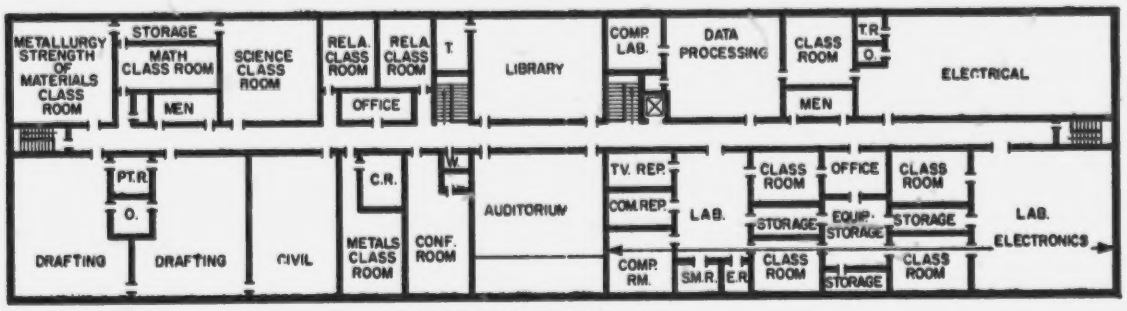
Supervise construction, issue change orders, issue payment certificates for contractors, and recommend final acceptance of complete structure.



BUILDING FLOOR PLAN

Rowan Industrial Education Center, Salisbury, N. C.

This floor plan follows a more compact design, with the various program areas arranged in independent suites yet readily accessible to other areas.



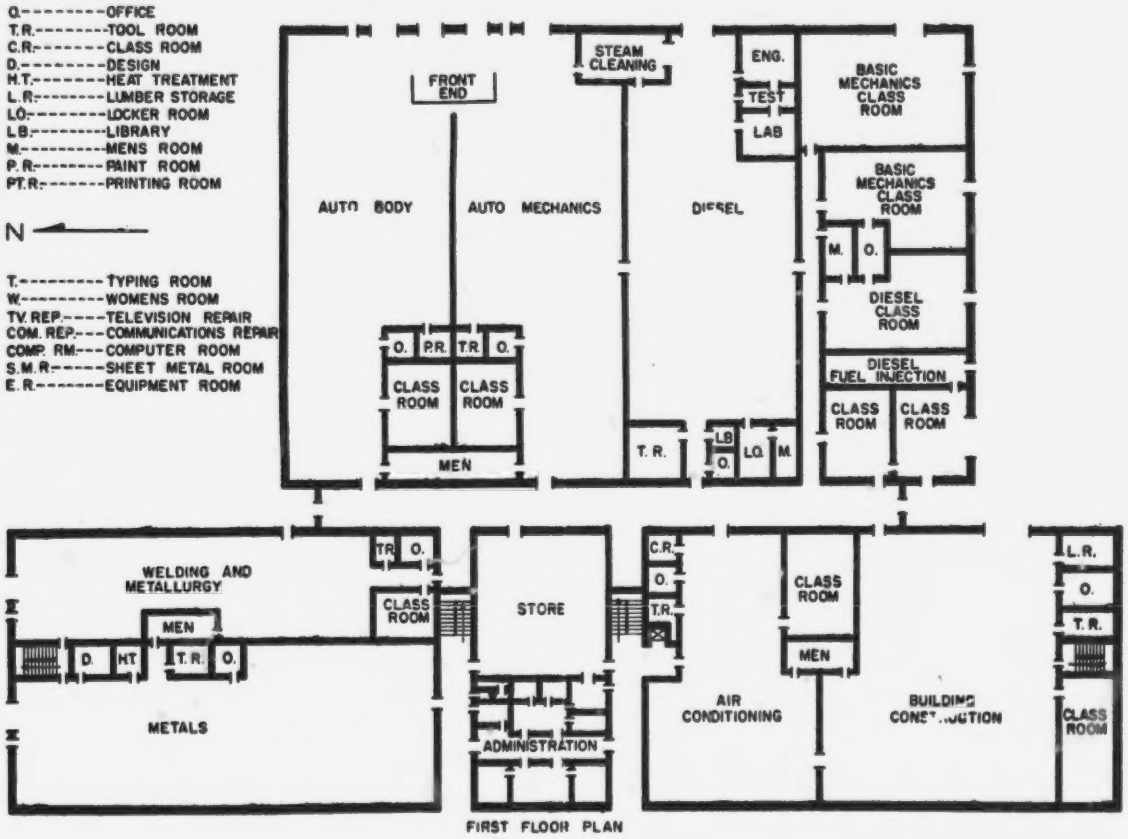
SECOND FLOOR PLAN

ROOM ABREVIATIONS

O.--------OFFICE
T.R.--------TOOL ROOM
C.R.--------CLASS ROOM
D.--------DESIGN
H.T.--------HEAT TREATMENT
L.R.--------LUMBER STORAGE
LO.--------LOCKER ROOM
LB.--------LIBRARY
M.--------MENS ROOM
P.R.--------PAINT ROOM
PT.R.-------PRINTING ROOM

N

T.---------TYPING ROOM
W.---------WOMENS ROOM
TV. REP.----TELEVISION REPAIR
COM. REP.---COMMUNICATIONS REPAIR
COMP. RM.---COMPUTER ROOM
S.M.R.-----SHEET METAL ROOM
E.R.--------EQUIPMENT ROOM



FIRST FLOOR PLAN

Nebraska Vocational-Technical School, Milford, Nebr.

This floor plan depicts a two-story arrangement of program and space relationships. The "light" shops and laboratories are located on the second floor, and the "heavy" shops and laboratories on the first floor.

BASIC CONSIDERATIONS FOR PLANNING VOCATIONAL EDUCATION FACILITIES

The Site

Size—Sufficient in area to provide space for:

- Present and future buildings.
- Outdoor instruction and recreation.
- Student, faculty, and visitor parking.
- Site beautification.
- Service drives, walkways.

Location

- Readily accessible to drive-in traffic.
- Availability of water, sewers, electricity, and gas at reasonable cost.
- Coordinated with community planning.

Criteria for Selection

Health and Safety

- Free of excessive noise, odors, smoke, dust, and congested traffic.

Suitability

- Adequate space for the various types of buildings, future expansion, drives, walkways, recreation, parkway.

Economy—The reasonable purchase price plus site features which preclude:

- Excessive excavation and hauling.
- Special footings or pilings.
- Special installations because of distances to public utilities.
- Construction and maintenance of long access drives.

Site Development

- Building located and oriented properly.
- Provision for placement of the building, drives, recreation areas, and parking space in proper relationship to one another.
- Provision for safe approaches to the site.
- Provision for site beautification.

The Building

Curriculum Dictates the Design

A prime factor in the planning of facilities for vocational and technical education is the realization that each of the areas has specific requirements which must be met. Further, these programs may vary with the specific training needs of each community. Since the building and other facilities are basically educational tools, they are essential to the educational process and will help to achieve the purposes of the program. Building design is, then, an expression of how the problems of educational program planning have been solved.

Design Considerations

Flexibility

Creation of a building which can be readily adapted to future learning requirements, enrollments, and methods of teaching.

Rearrangement of space in the building without major structural changes.

Multiple use of space for both day and night classes.

Expansibility

Increase in the floor area of a structure, either by expansion on the same level or by the addition of another story.

General environment

Proper control and balance of acoustics, heating, ventilating, lighting, and color.

Aesthetics

Imagination and creativity to meet emotional as well as physical needs.

Safety

Overall structural safety, traffic control, proper lighting, space for each item of equipment, removal of exhaust fumes, and suitable fire-fighting equipment for each area.

Economy

Adaptation of the building to the site; building spaces that are related functionally; building perimeter lines straight, simple, and short.

Program Considerations

- General classrooms for lecture or discussion-type activities.
- Laboratories and shops for demonstration and project activity.
- Preparation rooms and instructional supply storage.
- Project storage and student lockers.
- Library and resource materials.
- Classroom equipment and furniture.

Administration Considerations

- Private and general offices.
- Guidance, counseling, and conference rooms.
- Health clinic.
- Cafeteria and food service.
- Personnel records vault.
- Custodial and maintenance shops.
- Central supply receiving and storage rooms.
- Toilets, drinking fountains, and rest rooms.

Environmental Controls

- Proper heating and ventilation to control room air temperature, humidity, purity, and distribution.
- Acoustical treatment to control or minimize sound transmission in and between classrooms, shops, laboratories, and other areas.
- Balanced electrical lighting, natural light, and interior finishes.

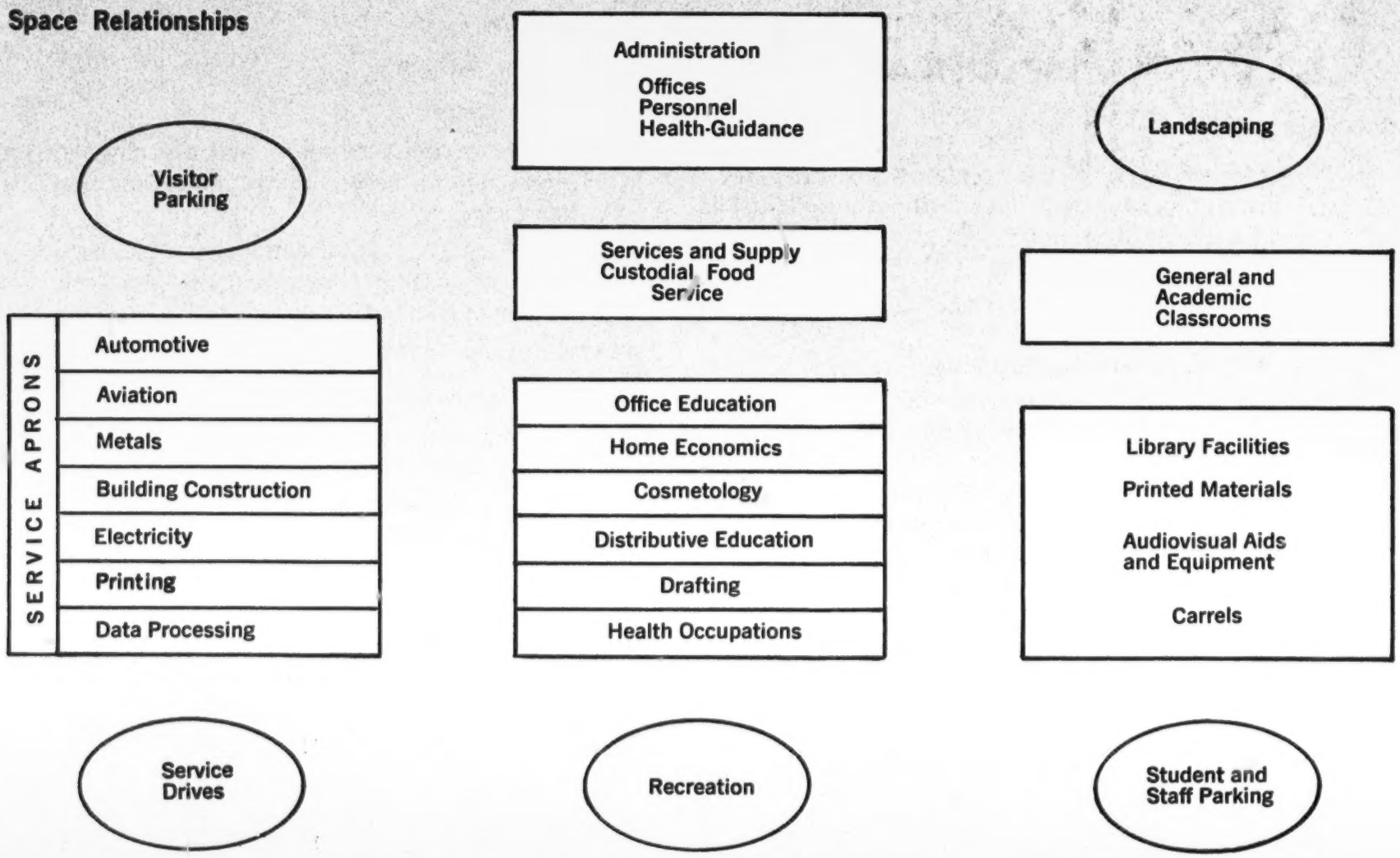
Auxiliary Needs

- Electricity, gas, and water.
- Sewage and waste disposal.
- Inter-communication system.
- Program clock and emergency bell system.
- Closed circuit TV.

Area and Space Relationships

- Proper relationships of each area to others to facilitate traffic flow, reduce noise and confusion, and to complement program planning.
- Noisy areas separate from other areas.
- Ease of movement of supplies and equipment.
- Accessibility of parking areas to the administrative offices and instructional learning areas.
- Various rooms or areas zoned for independent use as needed or desired.

Space Relationships



EDUCATIONAL SPECIFICATIONS

What Are They?

The written outline of the vocational and technical education program and the facilities needed to accommodate that program.

What Are Their Values?

Thorough examination of the needs will:

Stimulate more effective planning.
Promote economy in planning the facilities.
Aid in determining the number and types of rooms and space to be provided.
Serve the architect as a guide for building design.
Serve the students, faculty, and staff as a guide to utilize the building more effectively.
Provide for more cooperative planning and understanding of program objectives.
Emphasize the community's objectives and aims for the vocational and technical education program.

What Do They Include?

General requirements

Statement of the philosophy and objectives of the community for its vocational and technical education program.

A plan of the proposed vocational and technical education organization, program, and the groups to be accommodated.

A description of the educational facilities needed.

Detailed requirements

Statements of the philosophy and objectives of each of the subject offerings.

Space requirements, numbers, and kinds of rooms needed for each subject field.

Special utilities and service needs in shops and laboratories.

Relationships of spaces required or preferred.

Environmental factors needed or desired.

Miscellaneous information

- Traffic patterns—interior and exterior.
- Storage.
- Floor materials in shops and laboratories.
- Cleaning systems.
- Intercom, program bell, and clock systems.
- Furniture and equipment to be housed.
- Custodial services.
- Mechanical equipment.

Who Develops Them?

A combined effort of the following, operating under the legal authority of the local board of education:

- Administrative staff.
- Instructional staff.
- Educational consultants.
- Architects.
- Lay groups.
- Students.
- Occupational advisory groups.
- Representatives from management and labor and other responsible educational agencies.

GENERAL PLANNING SUGGESTIONS

Program Planning

Vocational education is designed primarily for those who have selected a vocational objective and wish to prepare for full-time employment in their chosen field.

Vocational education operations taught should closely parallel accepted industrial practices.

Programs and facilities should be planned and arranged so that day and night extension classes can be scheduled in the same rooms.

Careful attention should be given to include those programs which would be of greatest benefit to the largest number of students. Some programs may demand certain kinds or sizes of expensive equipment which might preclude other offerings of greater instructional benefit.

Shops should be designed to minimize the possibility of personal injury to occupants, damage to equipment, and discipline problems of inexperienced youth.

Location of Rooms

Vocational buildings should be designed to harmonize with surrounding buildings.

Shops should be separated from the general classrooms because of (1) the noise in the shops during instructional periods and (2) the necessity to move vehicles and equipment in and out with little confusion.

"Heavy" shops—automotive, aircraft, building trades, machine—should be located on the ground floors and, preferably, in one-story buildings.

"Light" shops and laboratories—electronics, barbering, cosmetology—may be located on an upper floor and near regular classrooms.

Concrete aprons should be provided adjacent to the shops for outdoor instruction, storage of vehicles and equipment, and more convenient access to the shops.

Exterior storage areas should be protected with chain-link fences and locked gates.

Shop and Laboratory Planning

The sizes of the shops and laboratories will depend upon their purposes. Those which are equipped with various sizes and kinds of motor-driven machines will also require open areas for assembly of projects and demonstrations.

The ideal shape of a shop or laboratory is rectangular. There should be no columns or structural protuberances of any sort.

The ceiling heights should vary with the nature of the program being planned, the types of machinery used, and the necessity for overhead cranes and hoists.

Two entrances should be provided for each shop or laboratory—one of which is a service entrance and the other, a student entrance. Outside doors should open outward or slide upward.

Wash fountains with both hot and cold running water and drinking fountains should be installed in each shop or laboratory area in addition to those provided in the general classroom wings. Toilet rooms should be easily accessible in each wing or section.

Ample storage rooms for student projects, instructional supplies, materials, tools, and other types of equipment should be provided in each shop and laboratory. Special storage arrangements for precision instruments should also be provided.

Storage rooms should not project into the shop or laboratory area.

An area adjacent to the shop is desirable for group instruction, planning, counseling, and office space.

Dust-proof finishing rooms with exhaust fans and special electrical switches and lights should be provided where painting and finishing is done.

Adequate floor drains should be installed for ease of cleaning and for the removal of rain or melting snow from vehicles brought in during inclement weather.

Display cases for exhibiting students' projects should be installed in corridors near the shops.

Each machine should be located so that adequate space is provided for the operator and the instructor, and for the safe handling of materials.

Each student should be provided with a locker for storage of personal belongings and incompleted shop projects.

Safety Precautions and Equipment

Proper kinds of fire extinguishers should be provided in the shops and laboratories.

Hazardous machines must be equipped with adequate guards and surrounded by guard rails appropriately painted.

Switches on power-driven machines should be of the safety type and placed to avoid accidental contact.

All machines should be controlled by a master switch under lock and key.

Safety switches for emergency should be installed throughout shop and laboratory.

All machines and motors should be grounded.

Adequate provision should be made for safely handling waste materials, oil, and paint rags.

Dust-collecting systems should be provided each woodworking machine.

Exhaust from all gasoline or diesel engines should be muffled and connected with an underground exhaust system.

SCHOOL CONSTRUCTION COSTS AND CAPITAL OUTLAY

Units of Measure for Estimating Construction Costs

Costs for school building construction are usually measured in cost per square foot, cost per cubic foot, cost per pupil, and cost per classroom. While there are rather wide ranges of cost within each of these units of measurement, approximations of the dollar equivalents among them for conventional construction are:

$15 per square foot	$1,850 per pupil
$1.05 per cubic foot	$35,000 per classroom

Methods of Determining Areas in School Buildings*

"Gross area of a building is the sum of the areas at each floor level included within the principal outside faces of exterior walls, neglecting architectural setbacks or projections.

"Include all stories or areas which have floor surfaces with clear standing head room (6 feet 6 inches minimum) regardless of their use. (Include mezzanines, balconies, and library stack floors only to the extent of their actual floor area; do not include unenclosed areas under the first floor.)

"Where a ground level or intermediate story, or part thereof, is left unenclosed, consider the gross area of the unenclosed story as the projected area of the story above.

"Exclude all unroofed areas and unenclosed roofed-over spaces. (Unenclosed roofed areas which have been included in original cost contracts can be excluded on a computed or estimated basis for the development of comparative data of gross building areas and costs.)"

* Defined by the American Standards Association

Variables in Cost Comparisons

1. Nature of the educational program to be housed.
2. Proportion of actual instructional space to total area of the building.
3. Number and kinds of educational equipment included in construction cost.
4. Labor wage rates and costs of construction materials.
5. Site preparation and development.

6. Availability of utilities.
7. Geographical location.
8. Design and type of building planned.
9. Construction methods utilized.
10. Building materials.
11. Cost trends.
12. Availability of labor for skills required.
13. Amount of off-site and on-site construction necessary.

Cost Estimates of School Construction

1. Indicate financial and educational program limitations within which the board and the architect can plan facilities.
2. Provide opportunities to add or delete alternates on the bidding for contracts.
3. Make it possible to plan for quality and quantity of space more scientifically.
4. Enable educators to establish and adjust priorities for program planning.

Proposed Construction Budget Items

1. Land acquisitions _____
2. Building contracts
   a. General _____
   b. Heating and ventilation _____
   c. Plumbing _____
   d. Electrical _____
   e. Other _____
3. Architect fees _____
4. Engineering services _____
5. Consultant services _____
6. Administrative expense _____
7. Legal services _____
8. Interest during construction _____
9. Insurance during construction _____
10. Site development _____
11. Contingencies _____
12. Clerk-of-the-works _____
13. Furniture and equipment _____

TOTAL

ECONOMIES IN PLANNING AND CONSTRUCTING VOCATIONAL EDUCATION SCHOOLS

School costs are measured in several ways: namely, in actual construction dollars, in initial cost, in long-range costs, and in educational returns for dollars spent. Many economies may be effected by reducing the cost of construction, but attention must also be given to other factors, such as:

Educational program planning—immediate and long-range

- Determine the needs in the area and courses necessary to meet these needs.

Site selection and acquisition

- Select site well ahead of actual need.
- Obtain sufficient acreage at the original purchase.

Design and planning procedures

- Plan well in advance of need to avoid hasty decisions.
- Obtain competent professional assistance.
- Prepare educational specifications.
- Adapt buildings to the site.
- Simplify the building design.
- Plan spaces which can be modified for other areas.

Basic construction patterns

- Use skeleton-type construction—non-load-bearing partitions.
- Adopt standardization of component parts.

Exterior design

- Keep lines straight and simple.
- Use desirable, easily maintained building material.
- Limit or avoid excessive ornamental trim.

Interior design

- Plan for multiple use of spaces.
- Orient program areas and classrooms properly.
- Provide overhead services for machines.

Building materials and finishes

- Use tested materials.
- Standardize hardware, doors, and windows.
- Use proper types of materials in special areas.
- Use indigenous materials where possible.

Design for multiple use of materials; for example, combination roof and ceiling.

Furniture and equipment

Select proper types and kinds needed for the particular vocational programs.

Locate heavy machinery near the service doors whenever feasible.

Building maintenance

Plan a program of preventative maintenance.

Plan for stability and low maintenance costs.

Administration

Select architect, legal counsel, educational and other consultants in the early stages of planning.

Arrange detailed and specific contracts with each consultant engaged.

Provide ample time for each of the planning steps.

Employ a clerk-of-the-works during the construction phase.

Financing

Maintain construction cost comparisons.

Prepare a capital outlay budget.

Study methods of financing.

Study bond interest rates.

GLOSSARY OF FACILITIES PLANNING TERMS

Assembly area: An area within the school shop, free of machinery and equipment, where the component parts of large instructional projects can be assembled.

Auxiliary facilities: Rooms or other facilities in or adjacent to the shop area which are used for special purposes; for example, toilets, dressing rooms, offices, visual aids room, storage rooms, and rooms or booths for painting, sanding, drying, welding, and the like.

Finishing room: An enclosed area, within or adjacent to a shop, which is used for spraying or painting projects or materials.

Instructional area: As applied to a shop, an area within the shop usually equipped with tables, chairs, instructor's demonstration desk, book cases, and other equipment which the instructor and groups of students may use for study and instruction or technical topics which are incidental to the shop instruction. The instructional area can be incorporated in the planning area.

Instructional material: A general term usually applied to all forms of printed materials used in instruction—including textbooks, reference books, trade journals, shop manuals, catalogs, student study guides, blueprints—as well as audiovisual and other materials used in the teaching-learning process.

Live engine: A mounted internal combustion engine in running condition, stripped of all nonessential parts and used for instructional purposes.

Model: A three-dimensional representation of a real object or device which has been altered in such a manner as to clarify the construction or operation of the real object.

Mock-up: An unnatural layout or arrangement of the working parts of an electrical, hydraulic, or mechanical assembly (usually mounted on a panel board) which clarifies the interrelationship of the several parts and which can be made to operate upon application of power.

Panel silhouette: A panel board, used for mounting hand tools and small shop equipment, on which the outlines of the mounted objects are painted in a contrasting color so that the absence of an object is easily noticed.

Planning area: An area within the shop, equipped with tables, drawing equipment, reference materials, and the like, which is used by students and instructor for planning and laying out instructional jobs or projects. The planning area can be incorporated in the instructional area.

Project: A complete object built or constructed by a student or group of students for instruction purposes.

Safety zone: A zone around a machine or work area, usually outlined with a painted stripe on the floor, outside of which a person is safe from possible injury.

School plant: The total physical facilities of a school, usually confined to one campus or general area.

Service entrance: A door or entrance large enough to admit a delivery truck.

Shop, "heavy": A term sometimes used to indicate a shop requiring large and heavy items of equipment.

Shop, "light": A term used to indicate a shop, such as commercial arts and radio shop, in which little, if any, heavy equipment is required.

Shop area: The total area of a shop used for instructional purposes, exclusive of classroom, wash room, toilets, and the like.

Supplies: Those expendable items which are necessary for shop instruction but which do not necessarily become a part of a job or project; for example, fuels, lubricants, abrasives, cutting tools, files, small drills, fastening devices, pencils, erasers, and similar supplies.

Tool panel: An upright wooden surface for mounting hand tools and small equipment used in shop instruction.

Trade preparatory shops: Shops operated by the school to prepare persons for an occupation.

Utility machine: A machine for general use in any type of shop work, including shop maintenance; for example, drill press, grinder.

Work station: A location within the shop which has the necessary facilities for one student to work as a part of his daily instruction; for example, individual machines (exclusive of utility machines), work benches, and tool rooms. A shop must have at least as many work stations as there are students enrolled in a given class.

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